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March 11, 2013

John C. Ledwith, IV
Building Inspector
Village of Tuxedo Park
80 Lorillard Road
P.O. Box 31
Tuxedo Park, New York 10987

RE: Tuxedo Road Retaining Wall

Dear Mr. Ledwith:

At the request of the Village, we have performed a brief investigation of the retaining wall on the east side of Tuxedo Road, in the vicinity of the residence at 262 Tuxedo Road. This wall has exhibited a noticeable bulge over the years, and earlier this week a large stone was dislodged from the wall landing in the ditch line along the road, resulting in immediate road closure. Weston & Sampson was called in to provide a preliminary assessment of the wall and to recommend measures for maintenance and/or reconstruction to restore the wall to a structurally secure condition.

BACKGROUND

This wall appears to be an old gravity retaining wall of laid-up stone masonry construction that is reportedly in excess of 100 years old, although the exact age and details of its construction are not known. The wall has reportedly exhibited a bulge over its central portion for a long period of time and has been mentioned in previous reports by this office. It would appear that the wall has been built in several different sections at differing times, judging from the different vintages of stone and mortar, as well as joint lines that may indicate that a lower wall existed at some time and was added to. The wall, in total, is several hundreds of feet in length and varies from several feet tall at the north end to over 12 feet tall near the southern end. The section of the wall of immediate concern that is the focus of this letter report is approximately 8 feet tall and 180 to 200 feet in length. This section of the wall exhibits a noticeable lean towards the road (away from the retained soil), with the top of the wall approximately 6 to 10 inches beyond vertical.

FIELD OBSERVATIONS

The following observations of the conditions affecting the wall were made:

- Investigation of the visible portions of the wall reveals that the wall is severely distressed in the bulging portion. Movement of the wall toward the road has necessarily resulted in the opening of joints and loosening of stones within their mortar beds. With no friction within the joints to hold stones in place, the stones are free to be released from the mortar bond and fall out. In addition to the stones that have fallen out, we identified several other stones that appear to be close to falling out.

- The topography of the hill behind the wall results in sheet flow of stormwater runoff directly to the back side of the wall, and several sinkholes were observed behind the wall indicating the erosion and displacement of soil. Water was heard flowing by the wall indicating the potential of a natural spring potentially contributing water behind the wall on a continuous basis.

- Weep holes were observed in the portion of the wall to the south of the bulge where the wall appears intact, while no weep holes were observed in the area of the bulge, possibly contributing to the accumulation of water behind the wall.

- The lean of the wall has been an on-going concern to Weston & Sampson and the Village, now with the visible loss of stones, the severity of the section of wall leaning toward the road, and the new information that has become available, it appears likely that at some point in the near future that the wall could exceed its natural stability and fail suddenly.

WALL STABILITY

Investigation of the visible portions of the wall indicates a general wall width of between 24 and 28 inches, with an average width of approximately 26 inches. The face of the wall is made up of variable sized stones approximately 12 inches thick creating a uniform wall face backed by stone and mortar fill. A quick preliminary analysis of the stability of this wall using generally accepted soil and masonry characteristics results in a calculated factor of safety of 1.0 – indicating that this wall has been marginally stable for its life under normal conditions. Any minor increase in overturning forces on the wall, such as water pressure or freeze/thaw action will tend to move the wall, as has been observed. We believe that the failure mode of this wall has been years of freeze/thaw action that incrementally pushed the wall during each freeze/thaw cycle, and the wall never returns to its original position. Years and years of incremental movement result in the accumulated displacement that is observed, which now appears to be reaching a critical level of displacement.

CONCLUSIONS AND RECOMMENDATIONS

Based on the new information relative to the wall thickness, construction, and stone size/thickness, it appears there is minimal to no factor of safety in the walls current condition. We conclude that this wall poses a threat to public safety, and we agree that the Village should leave that portion of Tuxedo Road closed until reconstruction of the wall can be completed. We recommend that the Village undertake the necessary design and construction activities to reconstruct the wall to modern structural standards.

As previously stated, the existing wall has a calculated factor of safety of 1.0, based on standard calculation methods and some assumptions of wall construction. This means the wall has minimal to no safety factor and does not appear to have adequate provisions (drainage blanket, drainage piping, weeps) for managing water behind the wall. This wall can be reconstructed in a fashion similar to its existing construction by increasing the wall thickness, utilizing mortars with adequate strength to allow the wall to act as a monolithic structure, and equipping the reconstructed wall with granular engineered backfills and drainage systems to allow for the management of stormwater. It will be necessary to completely remove a section of the wall approximately 200 feet in length, excavate and remove some of the native backfills behind the wall, and reconstruct the wall in a similar alignment with the enhancements described above. Design of the replacement wall needs to be performed by an Engineer licensed to practice in New York State. We recommend that the following steps be undertaken by the Village:

- Undertake field mapping and final design of a replacement wall for the 200+/- feet of wall that is not vertical. Design work to include plans, cross sections and details of construction suitable for bidding of a public works project.

- Prepare bidding documents including Notice to Bidders, Information for Bidders, Bid Forms, Contracts, General Conditions, and Technical Specifications (utilizing Village of Tuxedo Park standards).

- Bid and award the contract and begin construction in time for a spring start of construction.

If we are immediately authorized to proceed, we anticipate that the bidding documents can be completed and ready within approximately one month's time, allowing for the project to be advertised to bidders on April 8, 2013. Utilizing an abbreviated bidding period, the project could be awarded for construction at the Village's regular meeting on April 23, 2013.

If you have any questions or comments, please don't hesitate to contact me.

Very truly yours,

WESTON & SAMPSON

Jeffery F. Budrow, PE
Senior Associate

JFB/bav

cc: Hon. Thomas Wilson, Mayor

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